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ABSTRACT

This document presents an annotated listing of articles, conference papers, book chapters, papers, and books published in 1995 as a result of investigations carried on at the University of Pittsburgh's Learning Research and Development Center (LRDC). The publications are organized alphabetically by author and chronologically within each author's entries. Most references include an abstract. Entries are also tagged with one or more numbers that correspond to 19 research topics. Research topics are: (1) learning and instruction; (2) knowledge structures for learning; (3) assessment and evaluation; (4) education reform; (5) learning in school subjects, including math, science, literacy and social sciences; (6) reasoning and thinking; (7) learning and technology; (8) group and intergroup processes; (9) memory and learning; (10) concept acquisition; (11) developmental psychology; (12) language and communication processes; (13) the nature of skill and expertise; (14) social and cultural influences on learning; (15) texts, including comprehension and processing; (16) learning and teaching in the classroom; (17) learning disabilities and special education; (18) technical training and work skills; and (19) skill acquisition. The bibliography is accompanied by ordering information for publications lists and for publications directly available from LRDC. (DR)

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Learning Research and Development Center

Publications List Update

1995

Learning

RESEARCH AND DEVELOPMENT CENTER

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Mission of the Learning Research And Development Center

The Learning Research and Development Center (LRDC) investigates processes of learning and instruction and works with teachers, states, and school districts to incorporate research findings into educational practice. Since its founding in 1963, LRDC has probed the nature of thinking, knowing, and understanding in and beyond school. Its twofold mission has been to broaden our scientific insights into all aspects of learning and to support the use of research in instructional settings as varied as classrooms, industry, and museums.

Investigations at LRDC are grouped into five categories: processes of learning; learning in school; education policy and reform; learning and the world of work; and learning and technology. Research findings are applied, in collaboration and communication with education practitioners, to the development of instructional materials and programs and to a variety of efforts to improve instruction and training in schools and workplaces.

The publications listed in this volume reflect the breadth of this mission and constitute a record of LRDC's long-term commitment to research that can strengthen educational practice.

LRDC Research Scientists[1]

David Allbritton
Kevin D. Ashley
Isabel L. Beck
William E. Bickel
Michelene T. H. Chi
William W. Cooley
Robert Glaser
Leopold E. Klopfer
Gaea Leinhardt
Alan Lesgold
John M. Levine
Margaret G. McKeown
Johanna D. Moore
Sharon Nelson-Le Gall
Stellan Ohlsson
Charles A. Perfetti
Lauren B. Resnick
Leslie Salmon-Cox
Leona Schauble
Walter Schneider
Janet W. Schofield
Jonathan W. Schooler
Edward A. Silver
Kurt VanLehn
James F. Voss
William D. Wattenmaker
Naomi Zigmond

[1] The following people have either retired, or moved to a different university: Leopold Klopfer, Stellan Ohlsson, Leslie Salmon-Cox, Leona Schauble, William Wattenmaker, and Naomi Zigmond.

How to Use This Publications List

Entries in this list are organized alphabetically by author and chronologically within each author's entries. Most references include a brief abstract. The bracketed number(s) near the end of each abstract correspond(s) to the numbers on the Research Topic List below.

To order copies of publication lists, please use the form at the back of this list. Please refer to this form for charges for specific documents and enclose a check or money order made payable to the **University of Pittsburgh**. You should receive your order within two weeks of receipt of payment.

The majority of publications in this list must be ordered directly from the publishers of the books or journals in which they appear. Exceptions are reports published by the Learning Research and Development Center. There is a $3.50 service charge per copy for these reports. To order available publications, please send a check or money order (payable to the **University of Pittsburgh**) for $3.50 per copy to the address on the attached order form. Please be sure to indicate the title(s) of the publication(s) as well as the serial number(s).

Research Topics

1. Learning and Instruction
2. Knowledge Structures for Learning (includes conceptual change, role of prior knowledge in learning, knowledge analysis, explanation, etc.)
3. Assessment and Evaluation
4. Education Reform (includes curriculum revision & development, staff development, classroom redesign, school restructuring, etc.)
5. Learning in School Subject Matters:
   a. Math
   b. Science
   c. Literacy (includes reading, writing, English, etc.)
   d. Social Science (includes history, geography, political science, and social studies)
6. Reasoning and Thinking
7. Learning and Technology
8. Group and Intergroup Processes
9. Memory and Learning
10. Concept Acquisition
11. Developmental Psychology
12. Language and Communication Processes
13. The Nature of Skill and Expertise
14. Social and Cultural Influences on Learning
15. Texts (includes text comprehension, learning from written material, and text processing)
16. Learning and Teaching in the Classroom
17. Learning Disabilities and Special Education
18. Technical Training and Work Skills
19. Skill Acquisition

Aleven, V., & Ashley, K. D. (1995). Doing things with factors. In *Proceedings of the Fifth International Conference on Artificial Intelligence and Law* (pp. 31-41). New York: Association for Computing Machinery.

This paper describes an experiment in which a human tutor used the CATO program to instruct first year law students about legal argumentation with cases. The results of the experiment were that the experimental group did as well as the control group who received more traditional law school instruction and that arguments generated by CATO were graded significantly higher than those of the students. The authors work through a series of examples illustrating the ways in which the program induced students to integrate into their arguments their knowledge of the meaning and legal significance of factors and cases. [Topics: 2, 6, 7] 1995-001

Aleven, V., & Ashley, K. D. (1995). Using a well-structured model to teach an ill-structured domain. In *Proceedings of the Seventeenth Annual Conference of the Cognitive Science Society* (pp. 419-424). Mahwah, NJ: Erlbaum.

This paper describes an experiment in which a human tutor used the CATO program to instruct first year law students about legal argumentation with cases. The results of the experiment were that the experimental group did as well as the control group who received more traditional law school instruction and that arguments generated by CATO were graded significantly higher than those of the students. The authors work through a series of examples illustrating the ways in which the program induced students to integrate into their arguments their knowledge of the meaning and legal significance of factors and cases. [Topics: 2, 6, 7] 1995-002

Ashley, K. D., & McLaren, B. (1995). Reasoning with reasons in case-based comparisons. In M. Veloso & A. Aamodt (Eds.), *Proceedings of the First International Conference on Cased-Based Reasoning (ICCBR-95)* (pp. 133-144). Berlin: Springer.

This paper presents the design and results of a second formative evaluation of TRUTH-TELLER, a program designed to compare and contrast practical ethical dilemmas. It also reports on our techniques for enabling TRUTH-TELLER to reason about reasons in comparing pairs of ethical dilemmas in a context sensitive way and presents an extended example. [Topics: 2, 6, 7] 1995-003

Beck, I. L., McKeown, M. G., & Worthy, J. (1995). Giving a text voice can improve students' understanding. *Reading Research Quarterly, 30*(2), 220-238.

This article describes how the authors developed expository texts in an effort to engage students and enhance their comprehension. The texts were created by revising them to impart voice by including more active qualities of oral language and to impose coherence by emphasizing relationships. Four versions of a text passage were used: an original version from a social studies textbook, a revised version for greater coherence, and versions of the textbook and coherent passages that exhibited voice. Fourth graders were given one of the passages to read and then, immediately after reading, and again one week later, asked to recall the passage and to answer open-ended questions. Results were that immediately after reading, the voiced coherent passage held significant advantage over all passages in both recall and questions. The same results were obtained for questions in the delay condition, but differences for recall did not reach significance. [Topics: 5d, 15, 16] 1995-004

Berent, I., & Perfetti, C. A. (1995). A rose is a REEZ: The two-cycles model of phonology assembly in reading English. *Psychological Review, 102*, 146-184.

The authors propose a model of phonological assembly that postulates a multilinear representation that segregates consonants and vowels in different planes. This representation determines the online process of assembly: Consonants and vowels are derived in two consecutive cycles that differ in their automaticity. The model's temporal properties resolve critical contradictions in the phonological processing literature. Its claims are further supported by a series of English masking and priming experiments demonstrating that the contributions of consonants and vowels depend on target exposure duration and differ in their susceptibility to digit load. One methodological implication of the model is that regularity effects are not necessary evidence for assembly. This claim is supported by naming studies showing that vowel assembly requires long target durations, but short target durations permit consonant assembly despite null evidence for vowels. [Topic: 12] 1995-005

Bickel, W. E., & Hattrup, R. A. (1995). Teachers and researchers in collaboration: Reflections on the process. *American Educational Research Journal, 32*(1), 35-62.

This research describes a 54-month National Science Foundation-supported collaboration, the Thinking Mathematics Project, between the American Federation of Teachers (AFT) and the Learning Research and Development Center (LRDC) of the University of Pittsburgh wherein

expert teachers and cognitive researchers sought to codify the best of clinical and research knowledge of student learning and instruction for mathematics in the early grades. The authors draw on their documentation of the development of the collaboration between these two organizations and the teachers and researchers involved to provide highlights of participants' reflections of the collaborative experience. Lessons about what works and what doesn't when teachers and researchers attempt to build a common learning community are described. [Topics: 3, 4, 16] 1995-006

Buchanan, B. G., Moore, J. D., Forsythe, D. E., Carenini, G., Ohlsson, S., & Banks, G. (1995). An intelligent interactive system for delivering individualized information to patients. *Artificial Intelligence in Medicine, 7*, 117-154.

The quality of health care can be improved by improving the information exchange between the patient and the physician, particularly for patients with chronic conditions who must meet with their physician periodically. This paper reports some progress in using artificial intelligence and computer technology in providing individualized information for migraine patients. Ethnographic methods were used to investigate information needs in the clinic empirically and the results were used to inform the design of the system. The system encompasses both an interactive history-taking module and an explanation module that generates answers to patients' questions. Preliminary evaluations indicate that both physicians and patients evaluate the system positively. [Topics: 7, 14, 15] 1995-007

Cai, J., & Silver, E. A. (1995). Solution processes and interpretations of solutions in solving a division-with-remainder story problem. Do Chinese and U.S. students have similar difficulties? *Journal for Research in Mathematics Education*, 26(5), 491-497.

American students have well-documented difficulties in solving division-with-remainder (DWR) story problems, yet no research has been conducted to examine difficulties students in other countries might encounter in solving this kind of problem. This study examined Chinese students' successes and difficulties in solving a DWR problem. A detailed cognitive analysis of the written solutions and explanations provided by Chinese students suggested they had similar difficulties as those reported for American students. The cognitive difficulty of solving this problem derives not from mathematical computational requirements but rather from the sense-making requirement included in interpreting the computational result. The results of this study suggest not only the cognitive complexities of the DWR problem for Chinese students, but also suggest the potential value of conducting cross-national studies in mathematics based on detailed cognitive analysis of students' solutions to complex math problems. [Topic: 5a] 1995-008

Cooley, W. C. (1995). *Restructuring Allegheny County's public Schools*. Pittsburgh, PA: University of Pittsburgh, LRDC.

The debates about how to reform our schools continue to flourish. Educators, parents, politicians, businessmen, taxpayers, and others argue about how to make schools more equitable, more effective, and more efficient. Meanwhile, the problems persist. This paper focuses on the public schools in Allegheny County, an educational system that is governed by 43 independent districts. The first half of the paper examines the current status of these 43 school districts and illustrates the ways in which the system remains inequitable, ineffective, and inefficient. The paper then explores how a restructuring of the county's system of public education could improve these conditions. Since such a dramatic change in governance cannot and should not be expected to occur quickly, the paper also suggests next steps. This paper is number 22 in a series of Pennsylvania Educational Policy Studies. [Topics: 3, 4] 1995-009

Cooley, W. W., & Bechtel, D. P. (1995). *Ten year trends in school district budgets*. Pittsburgh, PA: University of Pittsburgh, LRDC.

This paper examines the changes in revenues and expenditures that have occurred in Pennsylvania's school district budgets during the past ten years. Findings showed that districts with enrollment increases enjoyed large increases in state and local revenues, while districts with a small tax base or large welfare populations experienced increased tax effort with lower revenue yields. The authors argue that state funding formulas should be less sensitive to enrollment change and more sensitive to the difficulty that some districts have in raising local revenues, and the to the difficulty other districts have because they serve large percentages of welfare families. This report is number 24 in a series of Pennsylvania Educational Policy Studies. [Topics: 3, 4] 1995-010

Cooley, W. W., & George, C. A. (1995). *Pennsylvania's classroom teachers: Their retirement, replacement and development*. Pittsburgh, PA: University of Pittsburgh, LRDC.

In this report, the authors examine data that are descriptive of current teachers, teachers who are vacating their positions, and new teachers who are

being hired to replace those who are leaving. They look at the current hiring practices of school districts, describing the manner in which districts find prospective teachers and prospective teachers find placements. The authors also suggest that cooperative ventures in teacher recruitment, candidate assessment, teacher placement, and professional development might be an improvement over current practices. This report is number 23 in a series of Pennsylvania Education Policy Studies. [Topics: 3, 4] 1995-011

Eurich-Fulcer, R., & Schofield, J. W. (1995). Correlated versus uncorrelated social categorizations: The effect on intergroup bias. *Personality and Social Psychology Bulletin, 21*(2), 149-159.

Previous research has shown that cross-cutting social categories, independent of one another, often seem to reduce discrimination between groups. In this article, the authors discuss the effect of correlated cross-cutting categories on intergroup relations. The authors hypothesize that cross-cutting categories, correlated with one another, will increase discrimination. In a study of female college students, subjects were divided into two groups and were led to believe that there was either no correlation, moderate correlation, or high correlation between the two categorization dimensions along which they were divided. Results showed that subjects exhibited more intergroup bias as the degree of correlation between correlation dimensions increased. Results showed that once categorizations become highly correlated, cross cutting categories may no longer work to reduce bias. However, performance evaluations, a situationally specific measure of bias, failed to yield the same pattern of results. [Topic: 8] 1995-012

Eurich-Fulcer, R., & Schofield, J. W. (1995). Wide-area networking in K-12 education: Issues shaping implementation and use. *Computers and Education, 24*, 211-220.

The demand for wide-area networking (WAN) for education at the K-12 level is rapidly increasing. However, there is little systematic understanding of those factors which play important roles in shaping usage of WAN at the K-12 level. By reviewing previous research pertaining to the use of computer networks in K-12 environments, as well as in business and the university arenas, this paper identifies issues that are likely to play a major role in shaping WAN usage in elementary and secondary education. Technical and logistical issues, issues related to the attitudes and characteristics of individual users, and social and organizational factors shaping WAN usage are all considered. [Topic: 7] 1995-013

Futoran, G. C., Schofield, J. W., & Eurich-Fulcer, R. (1995). The Internet as a K-12 educational resource: Emerging issues of information access and freedom. *Computers and Education, 24*, 229-236.

This paper explores issues likely to emerge as K-12 educators incorporate wide-area networking (WAN) into the curriculum and become both consumers and providers of materials on the Internet. Issues arising with regard to schools as information consumers include decisions regarding student access to resources which include those that large segments of the community will find objectionable or potentially harmful. Issues arising from the fact that schools using WAN are likely to become information providers also have several aspects: legal issues revolving around school boards as publishers of on-line resources; and student on-line behaviors that may reflect negatively on the school and the community, and how schools will deal with those behaviors without penalizing students educationally. This paper describes some approaches to dealing with these concerns based on what others have done and on experiences in a large-scale K-12 wide-area networking project called Common Knowledge: Pittsburgh. [Topic: 07] 1995-014

Hill, C. A., & Resnick, L. B. (1995). Creating opportunities for apprenticeship in writing. In J. Petraglia (Ed.), *Reconceiving writing, rethinking writing instruction* (pp. 145-158). Mahwah, NJ: Erlbaum.

Business and industry regard good communication skills as a key to employees' success and complain that many college graduates they hire cannot write. After contrasting workplace writing with academic writing, the authors conclude that most writing instruction within the university does not adequately prepare students for writing in various professions and that radical revision of such instruction may be necessary. [Topics: 1, 12, 14] 1995-015

Jones, E. F., & Nelson-Le Gall, S. (1995). The influence of personal effect cues on children's judgements of morality and disposition. *Merrill Palmer Quarterly, 41*, 53-69.

The influence of actor effect on children's moral and dispositional judgments was explored in two studies. Preschool, second-, and fifth-grade children heard stories in which the protagonists produced an intended or unintended outcome after exerting high or low levels of personal effort. Children made moral attributions and

cross-situational predictions of behavior for each protagonist. Only judgements of actors producing intended negative outcomes were influenced by level of actor effort. Age-related findings indicated that older children's judgments and predictions reflected coordination of the actor's effort with information about the actor's anticipated goal. In contrast, preschool children appeared to focus more on the relation between the actor's effort and the consequence of the actor's behavior. [Topics: 6, 11] 1995-016

Joram, E., Resnick, L. B., & Gabriele, A. J. (1995). Numeracy as cultural practice: An examination of numbers in magazines for children, teenagers, and adults. *Journal for Research in Mathematics Education, 26*, 346-361.

The authors compared the characteristics of rational numbers in various magazines. Their analysis indicates that adults are often presented with rational numbers that are related to each other and that, although teenagers have covered all the mathematics concepts frequently found in adults' texts, numbers in teenagers' texts do not appear to form a transition to those found in adults' texts. Implications for preparing students for the numeracy demands of everyday life are discussed. [Topics: 5a, 16] 1995-017

Katz, S. (1995). Identifying the support needed in computer-supported collaborative learning systems. In J. L. Schnase & E. L. Cunnius (Eds.), *Proceedings of the CSCL '95: The First International Conference on Computer Support for Collaborative Learning* (pp. 200-203). Hillsdale, NJ: Erlbaum.

Computer-supported collaborative learning (CSCL) systems hold the potential to enhance the effectiveness of peer learning interactions, assuming that these systems are truly supportive—i.e., capable of coaching collaborating peers as they work on problems and critique other students' solutions. The author argues that in order to achieve this goal, CSCL system developers need to know more about the types of coaching that students are typically able to provide each other during problem-solving activities, and what types of advice they need from more experienced students or mentors at various stages of their development in the instructional domain. CSCL system developers also need to know how human mentors provide such coaching, and—based on that information—to develop computer models of human guidance during collaborative interactions. The author describes a pilot study whose goals are to address these issues and to assess the effectiveness of the research methodology she devised for doing so. [Topics: 7, 8, 12] 1995-018

Kenney, P. A. (1995). A framework for the qualitative analysis of student responses to the extended constructed-response questions from the 1992 NAEP in mathematics. In D. T. Owens, M. K. Reed, & G. M. Millsaps (Eds.), *Proceedings of the Seventeenth Annual Meeting of the North American Chapter of the International Group for the Psychology of Mathematics Education* (1, pp. 175-180). Columbus, OH: ERIC Clearinghouse for Science, Mathematics, and Environmental Education.

The purpose of this investigation was to develop a general framework for analyzing the NAEP extended constructed-response questions qualitatively. The framework dimensions were based on information about the NAEP extended questions, and linked to important ideas in mathematics and cognitive psychology. A set of student responses to an extended constructed-response question from the grade-4 assessment was analyzed qualitatively according to appropriate framework dimensions. The findings suggest that the student responses could be analyzed qualitatively, but further investigation is needed to verify the adequacy of the framework. [Topics: 3, 5a] 1995-019

Lane, S., & Silver, E. A. (1995). Equity and validity considerations in the design and implementation of a mathematics performance assessment: The experience of the QUASAR project. In M. Nettles & A. L. Nettles (Eds.), *Equity and excellence in educational testing and assessment* (pp. 185-219). Boston: Kluwer Academic.

Considerations of how to assess students' attainments with respect to the new vision of mathematical proficiency and how to assess improvements that may result from curricular and instructional reforms that might be undertaken result from the current interest in student assessment issues in mathematics educational reform. Project QUASAR (Quantitative Understanding: Amplifying Student Achievement and Reasoning) aims to demonstrate that it is feasible and responsible to implement instructional programs that foster the acquisition of mathematical thinking and reasoning skills by middle school students in economically disadvantaged communities. This paper discusses QUASAR and the nature and role of assessment in the project, emphasizing the QUASAR Cognitive Assessment Instrument (QCAI). Information on the design principles, associated scoring rubrics, administration procedures, and the nature of student performance information reported to teachers and administrators are among the issues discussed. [Topics: 3, 4, 5a] 1995-020

Lane, S., Stone, C. A., Ankenmann, R. D., & Liu, M. (1995). Examination of the assumptions and properties of the graded item response model: An example using a mathematical performance assessment. *Applied Measurement in Education, 8*(4), 313-340.

With the growing popularity of performance assessments, the use of item response models for polytomously scored items has increased. However, prior to applying the graded item response model to data derived from a performance assessment, studies are needed to ensure that the assumptions and item parameter properties of the models are satisfied. This study examined the dimensionality of a mathematics performance assessment, the extent to which a subset of tasks is speeded, and the extent to which the item parameter estimates are stable over time. The results from confirmatory factor analysis on three testing occasions indicated that the mathematics performance assessment is unidimensional on each occasion. Results also showed an instability of the item parameter estimates and the speededness of tasks. Some potential reasons for the instability are discussed (e.g., the differential emphasis on instructional content between testing occasions may affect the stability of item parameters over time. [Topics: 3, 5a] 1995-021

Leinhardt, G., Young, K. M., & Merriman, J. (1995). Integrating professional knowledge: The theory of practice and the practice of theory. *Learning and Instruction, 5*(4), 1-8.

This article provides a commentary for featured articles in a special issue on the nature of professional knowledge in several professions—architecture, engineering, medicine, and teaching. The authors examine the tensions that exist between theory and practice, focusing on the dualities inherent in various forms of professional knowledge. Professional knowledge can vary by the location of the learning (in the academy or in practice), the type of knowledge (declarative or procedural), the generality of knowledge (abstract or specific), and the nature of principles (conceptual or pragmatic). After discussing how each of these features varies according to the location of learning, the authors discuss how transforming knowledge learned in one location into forms associated with the other location might lead to increased integration of professional knowledge and ultimately to more skillful practice. An extended example from the teaching profession illustrates the authors' meaning. [Topics: 2, 4, 13] 1995-022

Lesgold, A. (1995). Educational technology for developing countries. In *Marshaling technology for development: Proceedings of a symposium* (pp. 189-209). Washington, DC: National Academy Press.

What kinds of technology can be useful for the education and training needs of developing countries? This paper discusses underlying principles of suitability as well as particular examples. [Topic: 7] 1995-023

Levine, J. M., & Moreland, R. L. (1995). Group processes. In A. Tesser (Ed.), *Advanced social psychology* (pp. 419-465). New York: McGraw-Hill.

This textbook chapter summarizes current research on small group processes. [Topic: 8] 1995-024

Levine, J. M., & Russo, E. (1995). Impact of anticipated interaction on information acquisition. *Social Cognition, 13*(3), 293-317.

This paper reports on a study investigating how anticipated interaction with majorities and minorities of various sizes affects the cognitions of prospective group members. [Topic: 8] 1995-025

Martin, J., & VanLehn, K. (1995). A Bayesian approach to cognitive assessment. In P. Nichols, S. Chipman, & R. L. Brennan (Eds.), *Alternative approaches to cognitive assessment* (pp. 141-165). Hillsdale, NJ: Erlbaum.

Assessment of a student's knowledge is necessary to permit informed decisions concerning remediation, career moves, or teachers' evaluation. However, there are many obstacles to effective cognitive assessment. In this chapter, the authors address three. A cognitive assessment system should: (a) integrate data from multiple activities, (b) analyze the data in a statistically sound, defensible manner, and (c) provide assessments at multiple grain sizes. The authors present OLAE, a computer assessment tool that collects data about problem solving in elementary physics, analyzes that data with sound, probabilistic methods, and flexibly presents the results of analysis. [Topics: 2, 3, 5b] 1995-026

Martin, J., & VanLehn, K. (1995). Student assessment using Bayesian nets. *International Journal of Human-Computer Studies, 42*, 575-591.

The authors describe OLAE as an assessment tool that collects data from students solving problems in introductory college physics, analyzes that data with probabilistic methods that determine what knowledge the student is using, and flexibly presents the results of analysis. For each problem, OLAE automatically creates a Bayesian net that relates knowledge, represented as first-order rules, to particular actions, such as written equations. Using the resulting Bayesian network, OLAE

observes a student's behavior and computes the probabilities that the student knows and uses each of the rules. [Topic(s): 2, 3, 5b] 1995-027

McKeown, M. G., Beck, I. L., Kucan, L., & Sandora, C. A. (1995). *Second-year classroom implementation of Questioning the Author: New Teachers, new site* (Tech. Rep.). Pittsburgh, PA: University of Pittsburgh, Learning Research and Development Center.

This report summarizes the second-year implementation of Questioning the Author which involved providing less support for teachers at the initial site and an introduction to the project for teachers at a new site. Analysis of data across teachers involved in both first and second years allowed a profile of a Questioning the Author teacher to emerge. This teacher focuses on building and extending meaning rather than retrieving information, and reformulates student comments through paraphrasing and refinement rather than repetition. In this teacher's classroom, the proportion of talk is more evenly distributed between teacher and students, and students are involved in initiating comments and questions during discussion. [Topics: 5d, 15, 16] 1995-028

McLaren, B., & Ashley, K. D. (1995). Case-based comparative evaluation in TRUTH-TELLER. In *Proceedings of the Seventeenth Annual Conference of the Cognitive Science Society* (pp. 419-424). Mahwah, NJ: Erlbaum.

This paper presents a knowledge representation for practical ethical reasoning, our techniques for enabling TRUTH-TELLER to reason about reasons in comparing pairs of ethical dilemmas in a context sensitive way and presents new extended examples. It also reports on the design and results of a second formative evaluation of TRUTH-TELLER, a program designed to compare and contrast practical ethical dilemmas. [Topics: 2, 6, 7] 1995-029

McLaren, B., & Ashley, K. D. (1995). Context sensitive case comparisons in practical ethics: Reasoning about reasons. In *Proceedings of the Fifth International Conference on Artificial Intelligence and Law* (pp. 316-325). New York: Association of Computing Machinery.

This paper presents our techniques for enabling TRUTH-TELLER to reason about reasons in comparing pairs of ethical dilemmas in a context sensitive way and presents new extended examples. It also reports on the design and results of a second formative evaluation of TRUTH-TELLER, a program designed to compare and contrast practical ethical dilemmas. Comparisons with legal case-based reasoning are drawn. [Topics: 2, 6, 7] 1995-030

Mittal, V., & Moore, J. D. (1995). Dynamic generation of follow up question menus: Facilitating interactive natural language dialogues. In *Proceedings of the ACM/SIGCHI Conference on Human Facts in Computing Systems* (pp. 90-97). New York: ACM Press.

Most complex systems provide some form of help facilities. However, typically, such help facilities do not allow users to ask follow up questions or request further elaborations when they are not satisfied with the systems' initial offering. One approach to alleviating this problem is to present the user with a menu of possible follow up questions at every point. Limiting follow up information requests to choices in a menu has many advantages, but there are also a number of issues that must be dealt with in designing such a system. To dynamically generate useful embedded menus, the system must be able to, among other things, determine the context of the request, represent and reason about the explanations presented to the user, and limit the number of choices presented in the menu. This paper discusses such issues in the context of a patient education system that generates a natural language description in which the text is directly manipulable. [Topics: 1, 7, 12, 15] 1995-031

Mittal, V. O., Roth, S., Moore, J. D., Mattis, J., & Carenini, G. (1995). Generating explanatory captions for information graphics. In *Proceedings of the Fourteenth International Joint Conference on Artificial Intelligence* (pp. 1276-1283). San Mateo, CA: Morgan-Kaufmann.

Graphical presentations can be used to communicate information in relational data sets succinctly and effectively. However, novel graphical presentations about numerous attributes and their relationships are often difficult to understand. Therefore, automatically generated graphical presentations must either remain simple and conventional, or risk incomprehensibility. To alleviate this problem, systems can be designed to work with a natural language generator to produce explanatory captions. This paper presents 3 strategies for generating explanatory captions to accompany information graphics based on: 1) a representation of the structure of the graphical presentation; 2) a framework for identifying the perceptual complexity of graphic elements; and 3) the structure of the data expressed in the graphic. The authors describe an implemented system and illustrate how it is used to generate explanatory captions for a range of graphics from a data set about real estate transactions in Pittsburgh. [Topics: 7, 12] 1995-032

Moser, M., & Moore, J. D. (1995). Investigating cue selection and placement in tutorial discourse. In *Proceedings of the 33rd Annual Meeting of the Association for Computational Linguistics* (pp. 130-135). Cambridge, MA: MIT Press.

The authors' goal is to identify the features that predict cue selection and placement in order to devise strategies for automatic text generation. Much previous work in this area has relied on ad hoc methods. The authors' coding scheme for the exhaustive analysis of discourse allows a systematic evaluation and refinement of hypotheses concerning cues. They report two results based on this analysis: a comparison of the distribution of SINCE and BECAUSE in their corpus, and the impact of embeddedness on cue selection. [Topics: 12, 15] 1995-033

Moser, M., & Moore, J. D. (1995). Using discourse analysis and automatic text generation to study discourse cue usage. In *AAAI Spring Symposium on Empirical Methods in Discourse Understanding and Generation*. Menlo Park, CA: AAAI Press.

The authors' two stage methodology for the study of cue usage coordinates an exhaustive corpus analysis with a system for text generation. Coding of the corpus uses Relational Discourse Analysis, a synthesis of two previous accounts of discourse structure. In the first stage of their study, hypotheses about cue usage are evaluated and refined using the corpus analysis. Several initial results concerning how cues mark segment structure are presented here. In the second stage of their study, the results of the corpus analysis are used to determine a set of heuristics to be implemented in a system for text generation. The automatic generation of texts is then used to exercise and further evaluate the heuristics for cue placement. [Topics: 12, 15] 1995-034

Noll, D. C., Cohen, J. D., Meyer, C. H., & Schneider, W. (1995). Spiral k-space MRI of cortical activation. *Journal of Magnetic Resonance Imaging, 5*, 49-56. [Topic: 7] 1995-035

Ohlsson, S., & Jewett, J. J. (1995). Abstract computer models: Towards a new method for theorizing about adaptive agents. In N. Lavrac & S. Wrobel (Eds.), *Machine learning* (pp. 33-52). Berlin, Germany: Springer Verlag.

After a brief flourish in the decade 1979-1989, the study of learning has once again stalled. The main method for theorizing about learning—symbolic computer simulation—is plagued by serious difficulties. Abstract computer models, i.e., models that capture the structural features of cognitive processes while ignoring their content, overcome those difficulties. An example of abstract modeling is discussed and a research agenda outlined. [Topic: 19] 1995-036

Perfetti, C. A. (1995). Cognitive research can inform reading education. *Journal of Research in Reading, 18*, 106-115.

This paper discusses research about the cognitive processes that underlie skilled reading and learning how to read. There are four clear contributions of cognitive research that deserve special attention. They are: 1) Skilled readers read words rather than skip them. 2) Less skilled readers do rely on context. 3) Skilled readers use phonology in reading. 4) Children learn to read successfully by learning how their writing system works. These four deserve attention for three reasons. First, in each case the evidence is based on solid results from converging research. Second, in each case the results speak clearly to issues of reading instruction. Indeed, in each case they imply that certain reading goals should be privileged over others. Finally, these four solid results span a range of school levels from skilled reading through middle-grade to beginning reading. [Topics: 5c, 15] 1995-037

Perfetti, C. A., & Britt, M. A. (1995). Where do propositions come from? In C. A. Weaver III, S. Mannes, & C. R. Fletcher (Eds.), *Discourse comprehension: Essays in honor of Walter Kintsch* (pp. 11-34). Hillsdale, NJ: Erlbaum.

The short answer to the question "Where do propositions come from?" is parsing. Accordingly, this chapter reviews some of the parsing research and how parsing works as part of text processing. The role of syntax and context in parsing are both discussed. The chapter also covers the effect of a reader's text model on parsing, and the effect of lexical representations. Finally, a model for sentence parsing in discourse is discussed. [Topic: 15] 1995-038

Perfetti, C. A., Britt, M. A., & Georgi, M. C. (1995). *Text-based learning and reasoning: Studies in history*. Hillsdale, NJ: Erlbaum.

This book combines three key features in a unique examination of the course of learning and reasoning in history. It draws theory and analysis of text understanding from cognitive science and focuses on multiple natural texts of extended length rather than laboratory texts. The research demonstrates that history stories can be described by causal-temporal event models and that these models capture students' learning. Both student learning and reasoning is shown over time, as is a link between the two. The data illustrate that students' opinions are quite malleable on controversial issues. The book presents patterns of learning and reasoning across time for each

individual student and learning and reasoning improvements for the entire group. [Topics: 5d, 6, 15] 1995-039

Perfetti, C. A., Tan, L. H., Zhang, S., & Georgi, M. C. (1995). Why semantics lags behind phonology in word identification. In *Proceedings of the Seventeenth Annual Conference of the Cognitive Science Society* (pp. 683-687). Hillsdale, NJ: Erlbaum.

Because meaning is both the common outcome and the typical goal of language processing, including reading, semantic processes have received a privileged position, especially in cognitive science accounts that emphasize semantic, goal-driven components of language. Even in accounts of written word identification, a low-level process, it is typical to assume that semantic outputs are achieved with optional contributions of phonology. The goal of this paper is to present evidence for an alternative perspective, one that gives phonology a central rather than a peripheral, optional role in word identification. The authors first briefly discuss a writing system comparison that is important to this perspective. They then summarize recent published and unpublished research that gives definition to their conclusion that phonology is a central and universal component of word reading. [Topic: 12] 1995-040

Perfetti, C. A., & Zhang, S. (1995). The universal word identification reflex. In D. L. Medin (Ed.), *The psychology of learning and motivation* (Vol. 33, pp. 159-189). San Diego, CA: Academic Press.

This chapter focuses on the phonological reflex in the process of reading. By reflex, the authors mean the obligatory nature of the process. The central claim is that word identification consists of making available a familiar phonological form from a graphic input. The basic argument states that word identification, the recovery of a phonological object and its associated nonphonological components, is the fundamental obligatory process of reading. It is the central reading reflex. This chapter expands this claim and examines recent research on English and Chinese word reading. This research further supports Perfetti, Zhang, and Berent's (1992) idea of a Universal Phonological Principle (UPP). That is, across writing systems word identification appears to be based on the obligatory retrieval of phonology. [Topics: 12, 15] 1995-041

Perfetti, C. A., & Zhang, S. (1995). Very early phonological activation in Chinese reading. *Journal of Experimental Psychology: Learning, Memory, and Cognition, 21*, 24-33.

Is Chinese read by a process that bypasses phonology, or is phonology part of word identification as it is in alphabetic writing systems? Two experiments provide evidence that phonological information is activated as part of Chinese character identification. When participants made judgments about the meanings of pairs of characters, their reaction times and error rates to homophonic foils showed phonological interference. Correspondingly, when they made judgments about the pronunciation of pairs of characters, they showed semantic interference. The second experiment found phonological interference with only 90 ms stimulus onset asychrony (SOA) and semantic interference at 140 ms SOA. These results are accounted for by a class of models that assume that phonological names are constituents of word identification in Chinese. The results provide support for a universal principle of phonological processes in reading. [Topic: 12] 1995-042

Polk, T. A., VanLehn, K., & Kalp, D. (1995). ASPM2: Progress toward the analysis of symbolic parameter models. In P. Nichols, S. Chipman, & R. L. Brennan (Eds.), *Alternative approaches to cognitive assessment* (pp. 127-139). Hillsdale, NJ: Erlbaum.

Model-fitting, the problem of finding parameter settings that cause a model to fit given data as closely as possible, is a hard but important problem in cognitive science in general, and in cognitive diagnosis in particular. Efficient solutions have been found for certain types of model-fitting problems (e.g., linear & integer programming) that involve specific types of parameters (usually continuous) and models (usually linear). But these techniques usually do not apply to computational cognitive models whose parameters are often discrete and symbolic and whose internal workings must be treated as a black box for the purposes of fitting. The authors present Analysis of Symbolic Parameter Models, a set of computational tools for fitting and analyzing such symbolic parameter models, show how it can be used to fit and analyze computational models with well over 10 billion parameter settings, and describe a few changes in the initial design that will make it even more powerful and easier to use. [Topic: 3] 1995-043

Raghavan, K., & Glaser, R. (1995). Model-based Analysis and Reasoning in Science: The MARS curriculum. *Science Education, 79*(1), 37-61.

This article describes a model-centered, computer-supported, semester-long science curriculum for middle school students designed to encourage conceptual understanding and to foster

the development of model-based reasoning skills. In the Model-based Analysis and Reasoning in Science project, an environment is created that is conducive to fostering conceptual understanding and reasoning about scientific phenomena that involve balance of forces. Visual models that are dynamic and interactive are presented to concretize abstract ideas and for use as reasoning tools. The curriculum focuses on a network of concepts important for understanding hydrostatics. How students understand these concepts and use models as a disciplinary resource to engage in chains of reasoning that integrate concepts into networks of relations is of special interest for study. A major pedagogical question is how students can be taught to engage in model-based reasoning, a form of reasoning that scientists routinely use. [Topics: 6, 7, 16] 1995-044

Resnick, L. B. (1995). From aptitude to effort: A new foundation for our schools. *Daedalus, 124*, 55-62.
A changing U.S. economy demands that educators raise overall achievement levels and make opportunities for achievement more equitable. The author argues that all students must learn the high-level, embedded, symbolic thinking skills that our society now requires and that we must move from an aptitude-oriented education system to one designed primarily to foster effort. She considers five features and the implications of such a system. [Topics: 3, 4, 14] 1995-045

Resnick, L. B. (1995). Inventing arithmetic: Making children's intuition work in school. In C. A. Nelson (Ed.), *Basic and applied perspectives on learning, cognition, and development* (pp. 75-101). Mahwah, NJ: Erlbaum.
When young children enter school, they know a great deal about quantities and their relations. The organization of that knowledge seems to be consistent with the formal structures of mathematics. Why, then, do many children have difficulty learning math in school? In answering this question, the author raises some fundamental questions about the nature of knowledge and cognitive competence, the relations between cognition and social processes, and the role of schooling in adaptive sociocognitive development. [Topics: 1, 2, 5a] 1995-046

Resnick, L. B. (1995). Making high school count. In M. Higginbotham (Ed.), *What governors need to know about education reform* (pp. 85-89). Washington, DC: National Governors' Association.
This essay was part of a report intended to provide U.S. governors with diverse perspectives and insights into education reform issues. Raising questions about the current meaning of the high school diploma, Resnick asserts that it has little meaning today and that educators by themselves cannot make it count. She describes four steps (standards, certificates, deregulation, and professional development) that can make the diploma meaningful and provides questions to evaluate how far a state has gone in setting standards that work. [Topics: 3, 4] 1995-047

Resnick, L. B., & Nolan, K. (1995). Where in the world are world-class standards? *Educational Leadership, 52*(6), 6-10.
The authors report some findings of their research on education standards in other countries, featuring work from France, Germany, Japan, Sweden, and the Netherlands. They use this research to argue that setting clear, consistent, demanding, public standards helps students perform well. Evidence from around the world indicates that exams calling for complex, demanding tasks can be given to a wide range of students, perhaps even to all students. [Topics: 3, 16] 1995-048

Resnick, L. B., & Nolan, K. L. (1995). Standards for education. In D. Ravitch (Ed.), *Debating the future of American education: Do we need national standards and assessments?* (pp. 94-119). Washington, DC: The Brookings Institution.
The New Standards Project focuses the standards movement by defining functional standards. These standards require content statements, performance descriptions, good enough criteria, and benchmark examples of student work with commentary. Because they are desired goals rather than bureaucratic impositions, functional standards help educators and students to raise performance. New Standards is developing functional standards for language arts, mathematics, science, and applied learning. Teachers inform and learn from the process by administering and scoring reference exams and analyzing portfolios. Students produce benchmark performances by building portfolios using New Standards handbooks. The success of this work indicates that concrete models of functional standards can improve learning for all. [Topics: 3, 4] 1995-049

Schauble, L., Glaser, R., Duschl, R., Schulze, S., & John, J. (1995). Students' understanding of the objectives and procedures of experimentation in the science classroom. *The Journal of the Learning Sciences, 4*(2), 131-166.
A trend in recent studies of experimentation is toward a focus on activities that involve the integrated, long-term exploration of knowledge-rich, authentic domains of science. The research findings presented in this article

suggest that when it is effectively conducted, experimentation in the science classroom can engage students in reasoning about relevant scientific concepts and about the nature of experimentation itself. The authors offer instructional opportunities within the general context of experimentation that appear to be particularly appropriate for emphasis as middle school students engage in laboratory activities in their science classroom. Finally, the authors identify six opportunities for instruction that can make science experimentation more effective in the classroom. [Topics: 1, 5b, 6, 15] 1995-050

Schofield, J. W. (1995). Improving intergroup relations among students. In J. A. Banks & C. A. McGee Banks (Eds.), *Handbook of multicultural education* (pp. 635-647). New York: Macmillan. [Topic: 8] 1995-051

Schofield, J. W. (1995). Promoting positive intergroup relations in school settings. In W. D. Hawley & A. W. Jackson (Eds.), *Toward a common destiny* (pp. 423-433). San Francisco, CA: Jossey-Bass. [Topic: 8] 1995-052

Schofield, J. W. (1995). Review of research on school desegregation's impact on elementary and secondary school students. In J. A. Banks & C. A. McGee Banks (Eds.), *Handbook of multicultural education* (pp. 597-617). New York: Macmillan.
This chapter reviews the research on the academic and social impact of school desegregation on students. It concludes that although the literature has various methodological problems, which are discussed at some length, some conclusions can be drawn. With regards to academic achievement, the evidence suggests a positive impact on African American students' reading skills. Desegregation does not appear to pose a threat to the academic attainment of white students, as some have feared. School desegregation appears to contribute to the alleviation of segregation in other sectors of society, such as the workplace. Finally, there is some evidence that it contributes to the economic well-being and occupational attainment of at least some minority group members. [Topic: 8] 1995-053

Schofield, J. W. (1995). Understanding cooperative learning in schools (Review of *Interaction in cooperative groups: The theoretical anatomy of group learning*). *Contemporary Psychology, 40*(7), 640-641. [Topic: 8] 1995-054

Schooler, J. W., & Fiore, S. M. (1995). Stirring things up [Review of Gardner, H. (1993) Creating Minds]. *Applied Cognitive Psychology, 8*, 542-543.
This review briefly describes and evaluates a book on creativity. It is suggested that Gardner has developed a very interesting approach, and provides excellent summaries of the creative contributions of several of the towering figures of the 20th century. However, limitations of the approach are also noted. [Topic: 9] 1995-055

Silver, E. A. (1995). The nature and use of open problems in mathematics education: Mathematical and pedagogical perspectives. *Zentralblatt fur Didaktik der Mathematik, 95*(2), 67-72.
This article considers open problems in light of an apparent growth of interest in their use in mathematics education. Several varieties of openness are considered: problems that are unsolved in the field of mathematics, ones that are open with respect to the solution method, those that are open to interpretation of the problem or its plausible solutions, and ones that appear to invite other problems as a natural follow-up. The link between open problems and mathematical problem posing is also explored. An argument is made that open problems and their associated processes are central to the discipline of mathematics and to the nature of thinking as it occurs within mathematics itself and in the application of mathematics to solve applied problems. Various uses of open problems are discussed, as the emergent research base for such use. An argument is made for systemic research on the nature of the cognitive processes involved and on the use of open problems in instruction and assessment. [Topic: 5a] 1995-056

Silver, E. A. (1995). Rethinking algebra for all. *Educational Leadership, 52*(6), 30-33.
Algebra, sometimes called a gatekeeper to educational opportunity, has long been viewed as a critical course for students. Learning algebra provides more than a set of skills in dealing with quantitative relationships; it also introduces students to mathematics as a style of thinking involving modeling and abstraction. In this respect, mandated algebra instruction shares a common goal with the wider movement for mathematics reform, with both agendas seeking to increase the number of students who learn important mathematical ideas and to deepen their mastery of algebra skills. However, there is evidence that efforts to mandate algebra for all students have developed unevenly—and the results have been mixed. Using experiences of middle schools participating in the QUASAR project, this article discusses ways in which the goals of mandated algebra instruction and longer-term mathematics education reform might be combined for the benefit of all students. [Topics: 4, 5a] 1995-057

Silver, E. A. (1995). Shuffling the deck to ensure fairness in dealing: A commentary on some issues

of equity and mathematics education from the perspective of the QUASAR project. In D. T. Owens, M. K. Reed, & G. M. Millsaps (Eds.), *Proceedings of the Seventeenth Annual Meeting of the North American Chapter of the International Group for the Psychology of Mathematics Education* (Vol. 1, pp. 61-70). Columbus, OH: The ERIC Clearinghouse for Science, Mathematics, and Environmental Education.

This paper examines equity issues and mathematics education using examples from the QUASAR project and attempts to relate the work of the project to lines of inquiry associated with feminist research. Three aspects of the QUASAR project are discussed: the intentional focus on culturally and linguistically diverse student populations, the repertoire of instructional practices to fix the mathematics, and the role that such instruction can play in helping students develop identities as knowers and doers of mathematics. The need to assess student outcomes responsibly and fairly is also addressed, with the QUASAR Cognitive Assessment Instrument (QCAI) presented as an example of an assessment measure designed to be equitable, sensitive to change, and reflective of important mathematical learning outcomes. A call is made for future research in mathematics education to focus squarely on equity issues. [Topic: 5a] 1995-058

Silver, E. A., & Kenney, P. A. (1995). Sources of assessment for instructional guidance in mathematics. In T. Romberg (Ed.), *Reform in school mathematics and authentic assessment* (pp. 38-86). Albany, NY: State University of New York Press.

In this chapter, the authors discuss ways in which assessment information—whether from national or local tests or from classroom assessments—can be used to guide instructional decision-making in order to improve mathematics teaching and learning for all students. The relative limitations and strengths are examined for a variety of sources of assessment information available to teachers and other education professionals, including information from external sources (e.g., standardized achievement tests, international/national assessment surveys) and information from classroom-based assessments (e.g., classroom tests, observations, performance assessments). [Topics: 1, 3, 5a] 1995-059

Silver, E. A., & Lane, S. (1995). Can instructional reform in urban middle schools help students narrow the mathematics performance gap?: Some evidence from the QUASAR Project. *Research in Middle Level Education, 18*(2), 49-70.

The optimism of reform documents that all students can learn challenging mathematics is counter-balanced by surveys that suggest how little mathematics is actually being learned by the nation's students, especially children of color and those living in poverty. Results from the National Assessment of Educational Progress (NAEP) suggest that the performance gap between students who are affluent and students who are poor may be widening at the middle school level. Attempts to address the challenge of closing this gap are being made in the QUASAR Project. This article presents an analysis of the impact of QUASAR's mathematics instructional reform efforts on student mathematical performance on a set of questions from the 1992 NAEP mathematics assessment at grade 8. The findings suggest that providing students in economically impoverished communities with mathematics instruction aimed at reasoning, problem solving, and understanding can substantially increase their mathematical performance. [Topics: 3, 4, 5a] 1995-060

Silver, E. A., Leung, S. S., & Cai, J. (1995). Generating multiple solutions for a problem: A comparison of the responses of U.S. and Japanese students. *Educational Studies in Mathematics, 28*(1), 35-54.

A simple mathematics task, yet nonroutine in its call for the generation of multiple solution methods, was administered to about 150 U.S. students, most of whom were in fourth grade. Written responses were examined for correctness, evidence of strategy use and mode of explanation. Results from the U.S. sample were also compared to those obtained from about 200 Japanese fourth-grade students. Students in both countries (a) produced multiple solutions and explanations of their solutions, (b) exhibited almost identical patterns and frequency of strategy use across response occasions, and (c) used the same kinds of explanations, with a majority of the responses involving solution explanations that combined both visual and verbal/symbolic features. Nevertheless, Japanese students tended to produce explanations involving more sophisticated mathematical ideas (multiplication rather than addition) and formalisms (mathematical expressions rather than verbal explanations) than did U.S. students. [Topic: 5a] 1995-061

Silver, E. A., Smith, M. S., & Nelson, B. S. (1995). The QUASAR project: Equity concerns meet mathematics education reform in the middle school. In W. Secada, E. Fennema, & L. B. Adajian (Eds.), *New directions for equity in mathematics education* (pp. 9-56). New York: Cambridge University Press.

This chapter reviews the current crisis in mathematics education, with particular emphasis on the situation in schools serving poor communities. A case is made that mathematics instructional practice needs to be reformed by inventing forms of instruction which develop greater student understanding, blend basic skills with high-level thinking and reasoning, and encourage open communication among students and their teachers about mathematical ideas. Glimpses of instructional practices in schools and classrooms are presented to illustrate the context and content of instructional reform efforts within the QUASAR (Quantitative Understanding: Amplifying Student Achievement and Reasoning) Project. [Topics: 1, 4, 5a] 1995-062

Slotnick, S. A., & Moore, J. D. (1995). Explaining quantitative systems to uninitiated users. *Expert Systems With Applications (Special issue on Explanation), 8*(4), 475-490.

Previous work on the explanation of quantitative systems assumes that the user has at least a basic grasp of the formal approach of the problem-solving system. However, in realistic application situations, it is more likely that in order for the human user to understand why a mathematically based advice-giving system makes certain suggestions, the problem-solving rationale of the system must be explained in the user's terms. To develop an explanation methodology capable of justifying the results of a system based on quantitative reasoning to an uninitiated user, a representation is employed that enables the explanation facility to translate abstract mathematical relationships that make up a quantitative system into the domain-specific concepts with which a typical user approaches the problem-solving task. The process of generating explanations therefore involves translating one set of concepts into another. An added feature of system is its ability to provide explanations from two perspectives. [Topics: 12, 15] 1995-063

Slotta, J. D., Chi, M. T. H., & Joram, E. (1995). Assessing students' misclassifications of physics concepts: An ontological basis for conceptual change. *Cognition and Instruction, 13*(3), 373-400.

Physics novices and experts solved conceptual physics problems involving light, heat and electric current, and then explained their answers. Problems were multiple choice, with one correct response and 3 alternatives representing possible misconceptions. For each problem, an isomorphic material substance problem was constructed by imagining a materialistic conception of the physics topic and creating the resulting version of the problem. In each problem, one incorrect choice corresponded to the correct choice in the isomorphic problem. The empirical question was whether novices would reason about the physics problem as if it were conceptually similar to the substance isomorph. Subjects' responses to problem pairs were compared and their explanations for all problems examined. Content analysis revealed that physics novices were strongly inclined to conceptualize physics concepts as material substances, whereas expert protocols revealed distinctly non-materialistic representations. [Topics: 2, 3, 5b] 1995-064

Smith, M. S. (1995). One teacher's struggle to balance students' needs for challenge and success. In D. T. Owens, M. K. Reed, & G. M. Millsaps (Eds.), *Proceedings of the Seventeenth Annual Meeting of the North American Chapter of the International Group for the Psychology of Mathematics Education* (Vol. 2, pp. 181-186). Columbus, OH: The ERIC Clearinghouse for Science, Mathematics, and Environmental Education.

This study investigates a dilemma faced by an experienced teacher during the early stages of participating in a mathematics instructional reform project. The dilemma arose as the teacher's past practices came into conflict with new forms of instruction. Factors that assisted the teacher in dealing with the dilemma and arriving at a satisfactory resolution are identified. [Topics: 4, 5a, 16] 1995-065

Smith, M. S., & Silver, E. A. (1995). Meeting the challenges of diversity and relevance. *Mathematics Teaching in the Middle School, 1*(6), 442-448.

Current reform efforts have emphasized the need to change the way mathematics is taught and learned so that all students have access to a mathematics education that is rich in opportunities for thinking, reasoning, and problem solving. Reaching all students may not be easy, however, since within the classroom there may be considerable diversity among students not only with respect to prior mathematics achievement, but also with respect to ethnicity, language, and life experience. This article presents examples of how teachers in the QUASAR Project are attempting to make mathematics relevant for their culturally-diverse groups of students, while at the same time implementing programs which are aimed at thinking, reasoning, and problem solving. The examples represent some ways that those teachers have attempted to address issues of relevance and diversity by relating mathematics to children's life experiences, to students' interests, and to students' cultural heritage. [Topics: 4, 5a, 16] 1995-066

Suthers, D., & Weiner, A. (1995). Groupware for developing critical discussion skills. In J. L. Schnase & E. L. Cunnius (Eds.), *Proceedings of CSCL '95. The First International Conference on Computer Support for Collaborative Learning* (pp. 341-348). Mahwah, NJ: Erlbaum.

This paper discusses design features of a software system (Belvedere) to support collaborative processes of high school students engaging in collaborative reasoning; also describes formative evaluation studies and provides examples of student sessions. Reflecting on students' interactions with Belvedere and each other, the authors discuss the competencies and limitations of students in developing scientific argumentation and reasoning, as distinguished from and supported by their practice of everyday argumentation. [Topic: 7] 1995-067

Suthers, D., Weiner, A., Connelly, J., & Paolucci, M. (1995). Belvedere: Engaging students in critical discussion of science and public policy issues. In J. Greer (Ed.), *Artificial intelligence in education, 1995, Proceedings of AI-ED 95--7th World Conference on Artificial Intelligence in Education* (pp. 266-273). Charlottesville, VA: AACE.

This paper describes Belvedere, a system to support students engaged in critical discussion of science issues. The design is intended to address cognitive and metacognitive limitations of unpracticed beginners while supporting their practice of this complex skill. Both prior psychological research and formative evaluation studies with users shaped the interface design. The authors discuss their design rationale, describe their formative evaluation studies and provide examples of student sessions, and discuss ongoing work with the argumentation advisor. [Topic: 7] 1995-068

Thomason, R. H., & Moore, J. D. (1995). Discourse context. In *1995 Fall Symposium on Formalizing Context* (pp. 102-109). Menlo Park, CA: AAAI Press.

The authors discuss the problems of developing a theory of context that applies to the phenomena of naturally occurring discourse and that might be useful in assisting with the problems that arise in generating and interpreting discourse. The theories of context that have recently emerged in AI treat context as a determinant of literal meaning. This idea does in fact fit some natural language phenomena. But the authors suggest (1) that the account is inadequate for important effects that occur in discourse, and moreover (2) in discourse, the mutuality of context provides important constraints on the dynamics of context. The authors explore these ideas in the paper, and also describe an ongoing project that seeks to develop an empirically adequate and computationally useful approach to the problem of contextual effects on inference in discourse. [Topics: 7, 12] 1995-069

Voss, J. F., Wiley, J., & Carretero, M. (1995). Acquiring intellectual skills. In J. Spence, J. Darly, & D. J. Foss (Eds.), *Annual review of psychology* (Vol. 46, pp. 155-181). Palo Alto, CA: Annual Reviews.

This chapter is concerned with how intellectual skills are acquired, the review covering approximately six years, 1988-1993. As the authors use the terms, intellectual refers to skills important to human mental activity while acquisition refers to how such skills are learned. While the review follows most closely from Glaser and Bassok's (1989) review of instructional psychology, the present chapter's title acknowledges that intellectual skill acquisition takes place in non-classroom as well as classroom situations. The chapter contains four sections: domain-related intellectual skill acquisition, general intellectual skills, social contexts, and some significant issues. [Topics: 1, 5a, 5b, 5d, 10] 1995-070

Worden, M., & Schneider, W. (1995). Cognitive task design for FMRI. *International Journal of Imaging Systems and Technology, 6*, 253-270.

The quality of functional magnetic resonance imagining (FMRI) data is determined by the quality of scanning and the control of cognitive behavior of the individual being scanned. This report describes cognitive task design methodology. It is suggested that mapping the stages of cognitive processing is a technically achievable goal with current technology. The behavioral paradigms in FMRI are categorized into technique development and brain mapping paradigms. Technique development paradigms are used to tune scanning parameters with tasks such as visual mapping, motor responding, and language processing. Brain mapping paradigms generally examine uncharacterized areas of cortex. Three stages of brain mapping are described: determining number, location, and stability of active areas; topology and replication of areas; and exogenous/endogenous differentiation of areas. Issues of condition sequencing of tasks within and between trials, statistical analysis, and practical FMRI running are described. [Topic: 7] 1995-071

Worden, M., Vincent, D. J., Shedden, J., & Schneider, W. (1995). Constraining high density ERP source analysis using functional MRI. *Proceedings of the First World Congress in Computational Medicine and Public Health*. Austin, TX: First World Congress in

Computational Medicine and Public Health.
[Topic: 7] 1995-072

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